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PRETZEL PRODUCTION SYSTEM
[Brezelherstellungssystem]

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Description

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The invention relates to a mechanical, automatic pretzel production system, which has means for supplying U-shaped strands of dough to a downstream shaping unit which is made for holding the supplied U-shaped strand of dough and for its processing into a pretzel slug. Furthermore, the system has a pretzel slug removal means, which is assigned to the output of the shaping unit, and a gripping means, which is made for grasping or holding the ends of the strand of dough out of and/or in the shaping unit and can be moved linearly along the direction of conveyance of the strand of dough and the pretzel slug, which direction extends between the supply and removal means and along a transverse direction thereto. Furthermore, the pretzel production system has means for looping a pretzel knot from sections of the legs of the U-shaped strand of dough which is located in the shaping unit. The gripping means and the looping means can be controlled by a control. Furthermore, the invention relates to a combined gripping and looping device, a shaping unit and looping means which are each made and suitable for the pretzel production system as claimed in the invention.

DE 198 07 692 A1 and EP 0 938 844 A1 disclose a pretzel looping system in which a supply means with a conveyor belt is used, on whose surface a straightening wheel which can be turned by a motor with an axis of rotation which is vertical thereto is located and can be raised. It comes into contact with the delivered strands of dough while maintaining the U-shape and the strands are released for continued conveyance with lifting of the straightening wheel. The straightening

* Numbers in the margin indicate pagination in the foreign text.

wheel is assigned an angle transmitter for detecting its rotational path and the strand of dough which has been bent into a U-shape is assigned sensors for separate detection of one of its two ends at a time. The drive motor of the straightening wheel is controlled by a control means which is connected on the input side to the angle transmitter and sensors. Furthermore, the known looping system has two shaping units which are located downstream of the supply means. These units are operated in opposing cycles such that the first shaping unit is moved directly from the receiving position into the delivery position while at the same time the second shaping unit is moved conversely from the delivery position directly into the receiving position. With this looping system, a very high production rate can be achieved, but the structure, construction and manner of operation are complex.

DE 44 30 172 A1 discloses a means for producing pretzels which has a looping machine. Here strands of dough are used with an underlength, therefore a shorter length than the setpoint length. The strands of dough are deposited on the saddle of a receiving plate which is moved into an upper position. The two legs which are hanging down first each interrupt a stationary photoelectric barrier which each control one gripper at a time which is located at a defined distance above the photoelectric barriers. The grippers which are located at the same level can be moved in the vertical and horizontal direction and can turn around a horizontal axis. With increasing motion of the receiving plate upward, the photoelectric barrier detects the end of the strand and the pertinent gripper is closed. This control of the gripper results in that the two end sections of the strand of dough are held at

exactly the same distance from the end of the strand, even if the strand of dough should not have been deposited exactly symmetrically on the receiving plate. After the two grippers have grasped, the two end sections of the strand of dough, the receiving plate is moved up to such an extent that the length of the strand of dough is brought from the initially prevailing short size to the setpoint size. Otherwise, for the looping process and production of a pretzel slug a plurality of individual stations which are located in succession is proposed; this increases time consumption and construction effort.

DE 41 05 254 C1 discloses a device for looping of a pretzel out of a straight strand of dough which must in any case have a defined length. The device has a base for holding the strand of dough which can be raised out of the horizontal position. Overhead there is a two-arm lever which can be pivoted around a vertical axis. The respective free end of the two-arm lever moves in an arc into a horizontal plane. Furthermore there are two single-arm levers which are each pivotally connected to one lever arm of the two-arm lever arm and which can be pivoted essentially around an axis which is tilted out of the vertical. In the region of the end facing away from the pivoting axis a gripping element is attached. The production of the two-arm lever with additionally two single-arm levers is especially complex and expensive due to bends and oblique angles.

In a known pretzel shaping device of, for example, the initially named type (WO 94/03 068), the shaping means is a molding shell into whose shell bottom at least one groove or slot is molded which runs corresponding to the pretzel shape, looped lengthwise and/or bent. The strands of dough are inserted into this molding shell by a gripping

means. For this purpose, the gripping means has two grippers which are each assigned to one end of the strand of dough and which can be moved in the three orthogonal axes of space. In any case, the transfer of the initially straight strand of dough to the molding shell in an orientation which is exact for the pretzel is difficult. This imposes high demands on the quality and precision of the gripper guides. The looping of the pretzel knot is accomplished by turning the molding shell, after which the ends of the strand of dough projecting from the knot are pressed by the grippers by vertical motion onto the bent middle section of the pretzel slug. Thereupon, the mold shell is pivoted in the direction to a removal means; this, however, leads to the pretzel slug falling or being flung out and to a resulting adverse effect on shape.

The object of the invention is to increase the reproducibility and uniform precision of the pretzel shape in a pretzel looping system with attainment of increased operating reliability and to simplify and standardize the sequences of motion for the gripping means and/or the shaping unit. Along with this the production and operating costs of such a pretzel production system will be reduced and operability will be simplified. Moreover the flexibility of use will be increased especially with respect to the processability of strands of dough of different length.

To achieve this object, in the pretzel production system with the initially named features, it is proposed as claimed in the invention that the shaping unit be provided with positioning means for the strands of dough, which can be controlled by the control, and which is guided and can be driven linearly in and against the direction of

conveyance. With these positioning means, the strand of dough or the successfully shaped pretzel slug can be moved entirely or partially relative to the gripping means which holds the ends of the strand of dough in and against the conveyance direction, especially for purposes of stretching or transport. As claimed in the invention, the control on the input side is coupled to transducing sensors which are referenced or respond to the position of the ends of the strand, the gripping means and/or the looping means, and on the output side to a linear drive for the positioning means for its control. Thus it becomes /2
possible, by way of simple construction means and resources which can be produced economically and transparently, to, for example, stretch overly short strands of dough to the correct length or also to support the gripping means in the looping and transfer of the ends of the strand of dough to the middle part of the pretzel. The invention can be economically implemented with uniform linear drives and linear guides. At the same time the maintainability and thus also the availability are increased relative to the prior art. By the possibility of stretching or elongating, the preshaped pretzel strands even of differing length with the system as claimed in the invention, the requirement that the pretzel knot remains securely closed with completed looping can also be met. This is important since in the subsequent leaching process the leaching agent is not to penetrate into the closed knots. This would reduce the quality and adversely affect the appearance of the pretzel.

In conventional pretzel production processes, the length of the strand of dough varies. Conversely, the invention makes it possible to produce pretzel slugs of uniform size by different elongations which can be programmed, for example, by way of a freely programmable

control. This can take place, for example, in that for short pretzel strands greater elongation is applied than for longer strands. As claimed in the invention, this is achieved in that the shaping unit in which the pretzel is held especially during looping can be varied in its position as a result of its linear drives. One advantage which can be achieved with the invention consists in that the entire process of producing, a pretzel slug can proceed in the shaping unit, and moreover the pretzel slug can be moved by the positioning means to the removal means. In this way, the load on the pretzel strand and the deformation of the pretzel slug which has been successfully looped are reduced.

Within the framework of the general inventive idea, there is also a shaping unit with positioning means which comprise one or more conveyor belts, and one or more holding bodies which are structurally integrated and/or interact with it, both the conveyor belts and also the holding means being linearly guided in or opposite the conveyor direction. According to one especially advantageous execution, there are several such conveyor belts which run next to one another, and the holding bodies, especially made as retaining pins, project in between in the direction to the strand of dough in order to hold it. Here, it is feasible for the holding bodies to be connected to the indicated linear drive for mobility in and against the conveyor direction.

Within the framework of the invention, there is also a combined gripping and looping device, the gripping means and the looping means being structurally and/or functionally integrated with one another. The gripping means has two gripping members, which are each assigned to one end of the U-shaped strand of dough which is located in the shaping unit, and which are located on a common rotary yoke. The latter can be

moved rotationally by a rotary drive which can be controlled by the control and can be moved linearly in the transverse direction from and to the strand (36) of dough which is located in the shaping unit. In this way, the ends of the strand of dough can be looped with one another to form the knot and can be subsequently pressed onto the bent middle section of the pretzel slug by way of triggering the rotary drive.

Within the framework of the general inventive idea, there are furthermore looping means for the indicated production system which are characterized by looping elements which can be guided towards and away from one another and which are driven at a height between the shaping unit and the gripping means. For example, the ends of the loop guide elements which face one another are made clamp-like such that they are suitable for encompassing, circumscribing or clamping the leg sections of the strand of dough in their looping process.

Figure 1 shows a side view of the looping system as claimed in the invention,

Figure 2 shows a top view of the shaping table 2 with a partial view of the rotary head 24 as shown in section A-A, Figure 1, gripper 34 in the pivoted position,

Figure 3 shows a top view of the shaping table 2 with a partial view of the fingers 39, 40 and 41, 42 of the grippers 34 and 35 of a pretzel strand which has not yet been gripped,

Figure 4 shows top views of the shaping table 2 with the ends 36b of the pretzel strand gripped by the fingers 39, 40 and 41, 42,

Figure 5 shows a top view of the shaping table 2 with the guides 14 and 15 closed and the pretzel strand with a horseshoe shape,

Figure 5a shows a side view of the looping system as shown in Figure 5,

Figure 6 shows a top view of the shaping table 2 with the knots formed and with the guides 14, 15 opened,

Figure 6a shows a side view of the looping system with the rotary head 24 shown differently from Figure 6, turned 90°,

Figure 7 shows a top view of the shaping table 2 with the successfully looped pretzel slug,

Figure 7a shows a side view of the looping system as shown in Figure 7 with a representation of the opened fingers and extended ram 49 for depositing the ends 36b of the pretzel strand on the middle part 36a of the pretzel,

Figure 8 shows a top view of the shaping table 2 and an intermediate table 18 with the finished pretzel slug 45, and a newly arriving pretzel strand 36 which has been bent into a U-shape from the supply means 1,

Figure 8a shows a side view of the shaping table 2 with an intermediate table 18 and a partial view of the supply system 1, and with retaining pins 5 retracted, as shown in Figure 8,

Figures 9a/b show top views of the shaping table 2 with the pretzel mold 6 moved by an amount e.

Figure 1 shows the pretzel looping system in a side view. The supply means 1 used, for bending, measuring and orienting the U-shaped strands of dough, is known from patent applications DE 198 07 692.4 and EP 99103614.6. The further pretzel looping system consists essentially of the shaping table 2 whose conveyor belt in Figure 2 consists of narrow conveyor bands 3 and wide conveyor bands 4. The retaining pins 5

of the pretzel mold 6 project through the free intermediate spaces of the conveyor belt 2. The pretzel mold 6 with the retaining pin 5 is mounted on a lifting cylinder 7 via which the retaining pins 5 can be lowered into the shaping table 2 in direction 8, Figure 8a. The pretzel mold 6 is mounted stationary on a guide carriage 9. The guide carriage 9 is connected tightly to the toothed belt 10 in the region 50 and is driven by the drive motor 11. By way of the drive elements 10, 11 and the guide carriage 9 the pretzel mold 6 can be moved in directions 12 and 13. Above the shaping table 2, transversely to the conveyor direction there are guides 14 and 15 in Figure 2 with lifting cylinders 16 and 17. Following the shaping table 2 there are the intermediate table 18 with the conveyor belt 18a and the removal table 19 with the conveyor belt 19a. At the start of the conveyor belt 18 transversely to the direction 51 of travel there are sensors 20 and 21. Above the shaping table 2 and the intermediate table 18 there is the looping device 22. The looping device 22 consists essentially of a horizontal guide 37 with lifting cylinders 25, a vertical guide 28 with two /3
positioning cylinders 26 and 27, a rotary drive 29 with a rotary guide 52, and a rotary head 24. By means of the holding part 23, the vertical guide 28 with the cylinders 26 and 27, the rotary drive 29, the rotary head 24 can be moved jointly by way of the horizontal drive 37 and the lifting cylinder 25 in the horizontal direction. The rotary head 24 can be moved in the vertical direction with the lifting cylinders 26 and 27 and the linear guide 28. By means of the rotary drive 29 the rotary head 24 can be turned around the vertical axis 30 by 360°. The rotary head 24 on the top end consists of a yoke 31 on whose two ends the grippers 34 and 35 are arranged to be able to pivot around the vertical

axes 32 and 33 by means of the rotary drives 38, 39.

The U-shaped pretzel strand 36 coming from the supply means 1 in Figure 1 is transferred by means of the conveyor belts 3 and 4 onto the shaping table 2 until the middle part 36a of the pretzel strand 36 adjoins the retaining pins 5 of the pretzel mold 6, as shown in Figure 3. For this purpose the pretzel mold 6 is located in the outermost right-hand position, direction 13, and the retaining pins 5 in the uppermost position. As in Figure 3, the ends 36b of the pretzel strand lie on the intermediate table 18 and have passed the sensors 20 and 21. At the same time the rotary head 24 with the grippers 34 and 35 is moved into the lowermost position, direction 38, by extending the two lifting cylinders 26 and 27. Here, the fingers 39 and 40 of the right-hand gripper 35 and the fingers 41 and 42 of the left-hand gripper 34 come to rest in the region 46 between the shaping table 2 and the intermediate table 18. Thus, secure gripping of the ends of the pretzel strand is ensured. By moving the retaining pins 5 with the pretzel mold 6 by means of the drive elements 9, 10, 11 in direction 12, the pretzel strand 36 is pulled by the fingers 39, 40 and 41, 42 until the sensors 20 and 21 no longer detect the ends 36b of the pretzel strand. By way of the sensor 20 and a control which is not shown, the fingers 39, 40 of the right-hand gripper 35 are triggered for closing, gripping and holding fast the ends 36b of the pretzel strand. The same applies to the sensor 21 with the grippers 35, see Figure 4. Thus the strand ends 36b which are not opposite in parallel can be gripped independently of one another and individually with an exact length. After gripping the strand ends 36b the strand of dough is stretched to an adjustable size d, as shown in Figure 4a. After stretching the strand of dough the

following movements are carried out in part superimposed.

For this purpose, the looping means 22 with the rotary head 24 is raised in direction 47 by retracting the cylinders 26 and 27 and is moved in direction 48 by extending the cylinder 25 until the looping system 22 as shown in Figure 5a has reached the position for looping of the knot. By extending the cylinders 16 and 17 and closing the guides 14 and 15, a horseshoe shape is imparted to the pretzel strand, Figure 5. Thus, formation of a knot is improved and the pretzel strand 36 is prevented from moving out of the retaining pins 5. With the rotary drives 38 and 29, the grippers 34 and 35 are pivoted toward one another around the vertical axes 32 and 33 of rotation in the direction 43 and 44, Figure 2. The gripper 35 with the fingers 39 and 40 and the gripper 34 with the fingers 41 and 42 are pivoted until they form one right angle at a time with the ends 36b of the strand of the successfully looped pretzel 45, Figure 7.

At this point, the rotary head 24 is turned by 360° by way of the rotary drive 29 around the pivoting axis 30 to form the knot, as shown in Figures 6/6a. After forming the knot, the guides 14 and 15 are opened by retracting the lifting cylinders 16 and 17, as shown in Figure 6. So that the ends 36b of the pretzel strand can be deposited at a given position of the pretzel, the pretzel strand 36 is moved to the right in direction 13 by moving the retaining pins 5 with the pretzel mold 6 by an amount as shown in Figures 9a/b via the drive elements 9, 10, 11. By extending the lifting cylinder 27 in direction 38, by opening the fingers 39, 40 and 41, 42 and extending the ram 39 between the fingers the ends of the pretzel strand 36b are pressed onto the middle part 36a of the strand of dough, see Figure 7a. The pretzel

slug 45 is now finished. For further transport, the retaining pins 5 are pulled out of the pretzel slug 45 in direction 8 by means of the lifting drive 7 and are released by retracting the lifting cylinder 27, in direction 48. The pretzel slug 45 is conveyed by means of the conveyor belts 3, 4, 18a for further handling onto the removal table 19, Figure 8a. At the same time, a new pretzel strand 36 is transferred from the supply unit 1 to the shaping table 2, as shown in Figure 8. The looping means 22 with the rotary head 24 and the grippers 34 and 35, and the retaining pins 5 with the pretzel mold 6 are moved into the initial position, as shown in Figure 1, for holding the next or new pretzel strand, as shown in Figure 1.

Reference number list

1	supply means
2	shaping table
2a	conveyor belt
3	narrow conveyor band
4	wide conveyor band
5	retaining pin
6	pretzel mold
7	lifting cylinder for retaining pin
8	(vertical) direction for retaining pin
9	guide carriage
10	toothed belt
11	drive motor
12	direction
13	direction
14	guide

15 guide

16 lifting cylinder

17 lifting cylinder

18 intermediate table

18a conveyor belt

19 removal table

19a conveyor belt

20 sensor

21 sensor

22 looping device

23 holding part

24 rotary head

25 lifting cylinder

26 positioning cylinder

27 positioning cylinder

28 vertical guide

28a linear guide

29 rotary drive

30 vertical axis

31 yoke

32 vertical axis

33 vertical axis

34 gripper

35 gripper

36 pretzel strand

36a middle part

36b end of strand

37	horizontal guide
38	rotary drive /4
38a	direction
39	rotary drive
39a	gripper finger
40	gripper finger
41	gripper finger
42	gripper finger
43	direction
44	direction
45	pretzel slug
46	region
47	direction
48	direction
49	ram
50	region
51	direction of travel
52	rotary guide
d	stretching process
e	amount of movement

Claims

1. System for mechanical pretzel production, with a means (1) for supplying U-shaped strands (36) of dough to a downstream shaping unit (2) which is made for holding the supplied U-shaped strand (36) of dough and for its processing into a pretzel slug (45), with a pretzel slug removal means (18, 19) which is assigned to the output of the shaping unit (2), with a gripping means (34, 35) which is made for grasping or holding the ends (36b) of the strand of dough out of and/or in the shaping unit (2) and can be moved linearly along the direction (51) of conveyance of the strand of dough and the pretzel slug between the supply and removal means (1; 18, 19) and a transverse direction (38, 47) thereto, and with means (22, 29, 30) for looping of a pretzel knot from sections of the legs of the U-shaped strand (36) of dough which is located in the shaping unit (2), and the gripping means (34; 35) and the looping means (14-17; 22, 29, 30) can be controlled by a control, characterized in that the shaping unit (2) is provided with positioning means (3, 4; 5) for the strands of dough, which means can be controlled by the control, and which are guided (9) and can be driven linearly (10, 11) in and against the direction (51) of conveyance, by means of which the strand (36) of dough or the pretzel slug (45) can be moved entirely or partially relative to the gripping means (34, 35) which holds the ends of the strand (36b) of dough in and against the conveyor direction (51), the control on the input side being coupled to transducing sensors which are referenced or respond to the position of the ends (36b) of the strand, the gripping means (34, 35) and/or the looping means (22. 29, 30), and on the output side being coupled to a linear drive (10, 11) for the positioning means (3, 4; 5)

for its triggering.

2. System as claimed in Claim 1, characterized in that the control can be set with the amount (d) of stretching of the strand of dough, according to which when the ends (36b) of the strand of dough are grasped by the gripping means (34, 35) the linear drive (10, 11) of the positioning means (3, 4; 5) can be triggered for stretching or moving the strand (36) of dough in the direction (12) away from the gripping means (34, 35) which holds the ends (36b) of the strand of dough.

3. System as claimed in Claim 1 or 2, characterized in that the control can be set with an amount (d) of offset of the strand of dough, according to which after completion of the knot by the looping means (22, 29, 30) the linear drive (10, 11) of the positioning means (3, 4; 5) can be moved for offsetting or shifting the strand (36) of dough in direction (13) to the gripping means (34, 35) which holds the ends (36b) of the strand of dough such that the ends (36b) of the strands of dough can be placed on the remaining strand (36a) of dough by adjusting the gripping means (34, 35) in the transverse direction (38).

4. Shaping unit (2) for the system as claimed in one of the preceding claims, characterized in that the positioning means (3, 4; 5) comprise one or more conveyor belts (3, 4) and one or more holding bodies (5) which are structurally integrated and/or which interact with the belt, the conveyor belt or belts (3, 4) and/or the holding bodies (5) being linearly guided in or against the conveyance direction.

5. Shaping unit (2) as claimed in Claim 4, several such conveyor belts (3, 4) running at a distance next to one another, and in between a plurality of holding bodies (5) being arranged projecting such that the latter for the bent section (36a) of the U-shaped strand (36) of

dough or for the round middle section of the pretzel slug, which section is separated from the knot, form a holding saddle, characterized in that the holding bodies (5) are guided by the linear drive (10, 11) in and against the conveyor direction (51).

6. Combined gripping and looping device for a system as claimed in one of the preceding claims, characterized in that the gripping means (34, 35) and the looping means (22, 29, 30) are structurally and/or functionally integrated with one another by the gripping means (34, 35) having two gripping members (39a, 40; 41) which are each assigned to one end of the U-shaped strand of dough which is located in the shaping unit, and which members are located on a common rotary yoke (31) which can be moved rotationally by a rotary drive (29) which can be controlled by the control, and which yoke can be moved linearly in the transverse direction from and to the strand (36) of dough which is located in the shaping unit (2).

7. Device as claimed in Claim 6, characterized in that the rotary yoke (31) for the gripping elements (39a, 40; 41) has two attachment sites which are located at a distance to one another which corresponds to the distance of the ends of the U-shaped strand (36) of dough which is located in the shaping unit (2).

8. Device as claimed in Claim 6 or 7, characterized by a rotary yoke (31) which is guided such that its axis (30) of rotation runs solely transversely to the top side and/or support side of the shaping unit (2).

9. System as claimed in one of the preceding claims, characterized in that in the initial phase the linear drive (10, 11) of the positioning means (3, 4, 5) can be triggered by the control such that

the ends (36b) of the strand (36) of dough located U-shaped in the shaping unit (2) come to rest on the removal means (18, 19), and in a later phase the linear drive (10, 11) of the positioning means (3, 4; 5) can be triggered by the control such that the ends (36b) of the strand (36) of dough are pulled by the removal means (18, 19) to the shaping unit (2), and the gripping means (34, 35) can be triggered by the control such that it acquires the ends (36b) of the strand of dough, when their position between the shaping unit (2) and the removal means (18, 19) can be ascertained.

10. System as claimed in Claim 9, characterized by sensor means (20, 21) which are connected to the input of the control and which are made and arranged in the region between the output of the shaping unit (2) and the input of the removal unit (18, 19) for detecting the ends (36b) of the strand of dough. /5

11. Looping means (14-17; 22, 29, 30) for the system as claimed in one of the preceding claims, characterized by loop guide elements (14, 15) which can be guided towards and apart from one another and which are linearly driven (16, 17) transversely to the conveyor direction (51) between the shaping unit (2) and the gripping means (34, 35), and which are made for encompassing, circumscribing or clamping the leg sections (36b) of the strand of dough in the looping process.

12. System as claimed in one of the preceding claims, characterized in that the removal means (18, 19) has an intermediate table (18) with a conveyor belt (18a) whose input is directly opposite the output of the shaping unit (2), and a downstream removal table (19) with a conveyor belt (19a), the conveyor belt (18a) of the intermediate table (18) being made for operation with different speeds.

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8 pages of drawings attached

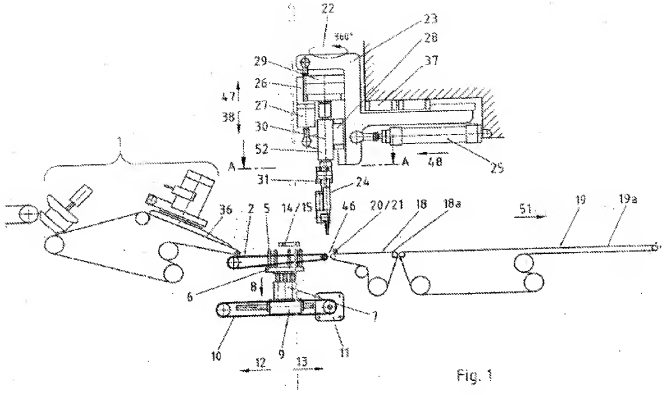
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Fig. 1

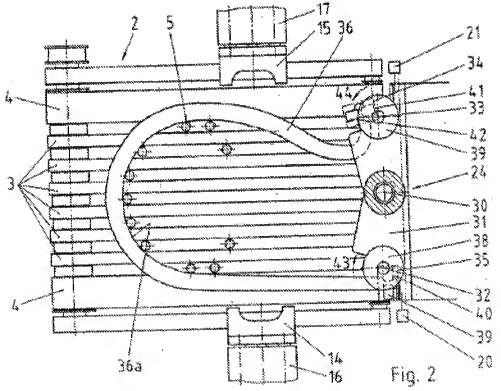
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Fig. 2

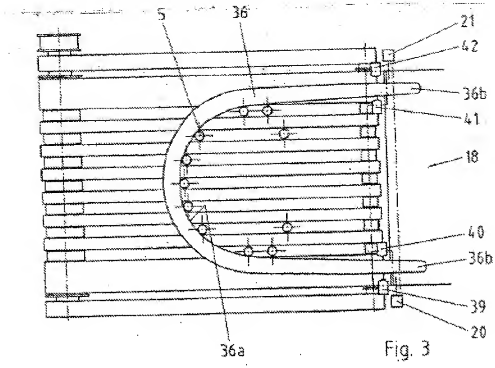

Fig. 3

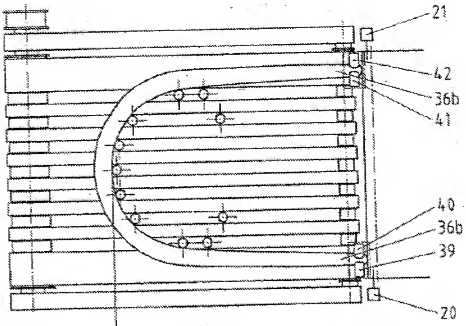

Fig. 4

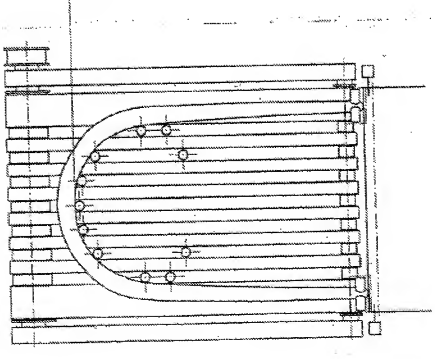

Fig. 4a

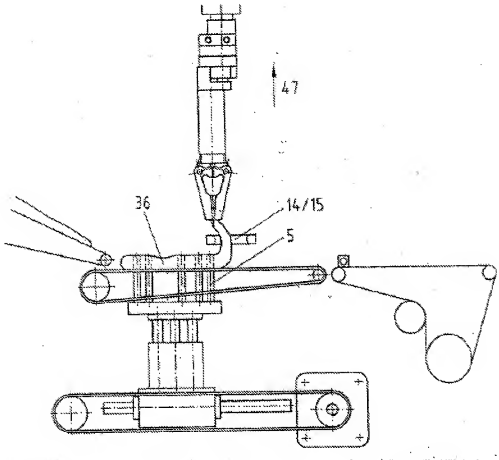

Fig. 5a

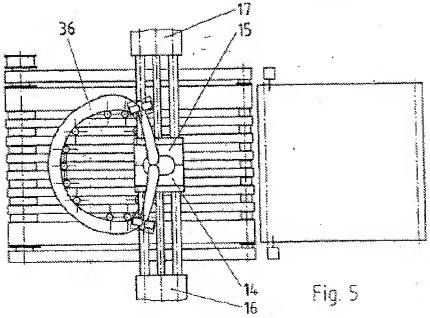

Fig. 5

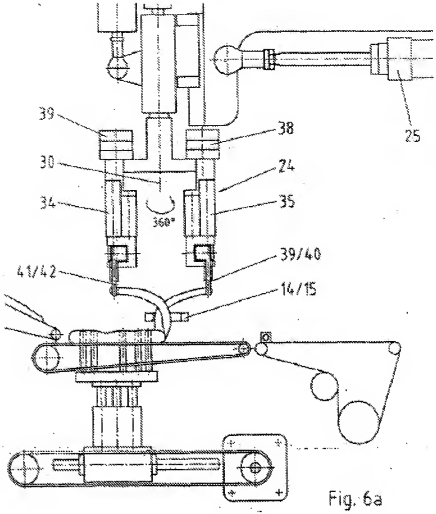

Fig. 6a

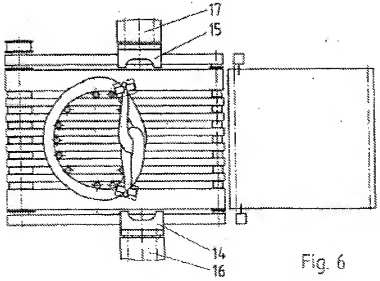

Fig. 6

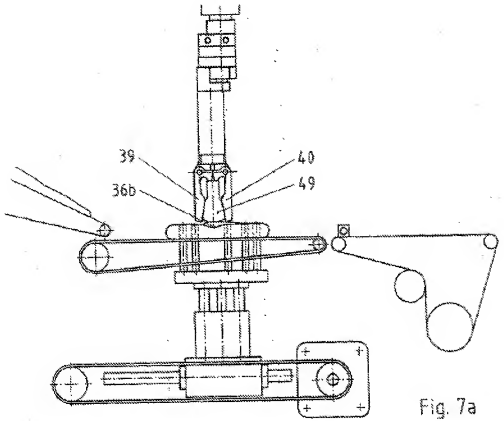

Fig. 7a

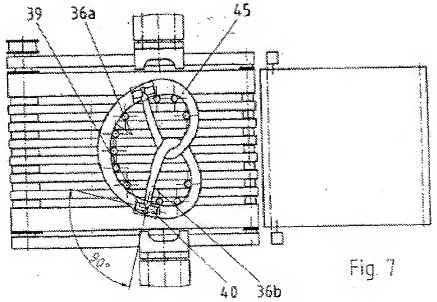

Fig. 7

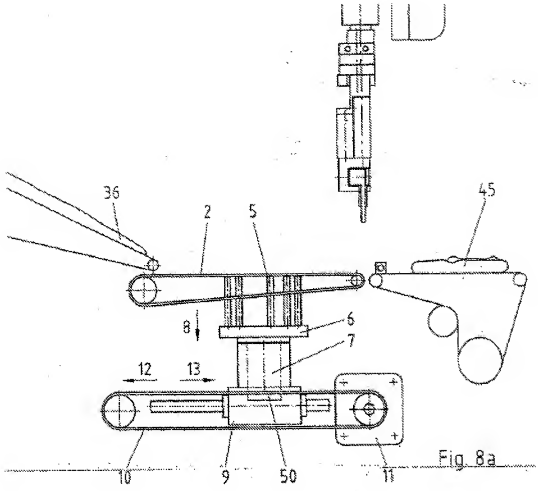

Fig. 8a

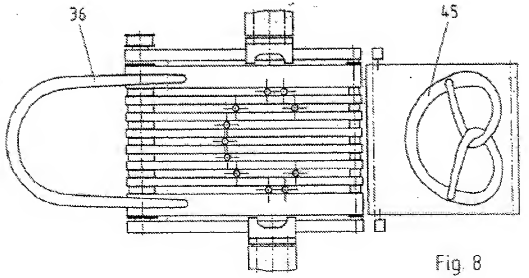

Fig. 8

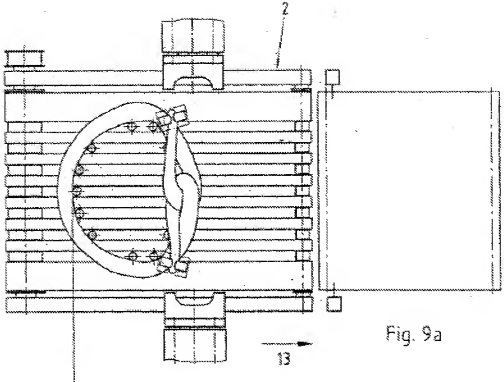

Fig. 9a

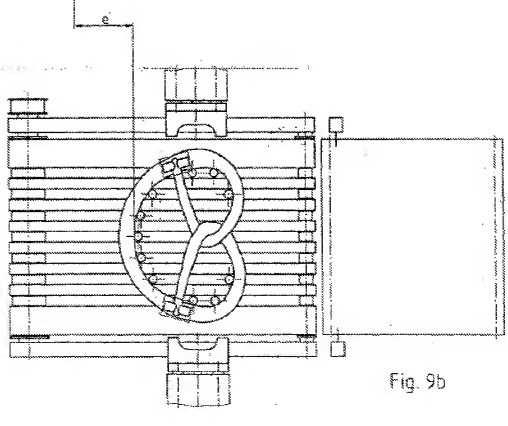

Fig. 9b